PROCEEDINGS

OF

THE ROYAL SOCIETY.

1834–1835. No. 21.

June 4, 1835.

The Rev. GEORGE PEACOCK, M.A., Vice-President, in the Chair.

Edward Blackett Beaumont, Esq.; William Borrer, Esq.; John Davidson, Esq.; Sir Richard Dobson, Knt.; Thomas Jones, Esq.; Thomas Mayo, M.D.; Benjamin Oliveira, Esq.; and Captain William Symonds, R.N., were elected Fellows of the Society.

M. Elie de Beaumont; M. Frederick Cuvier; M. Flourens; Professor Hanson; and Dr. Rosenberger, were elected Foreign Members of the Society.

The reading of a paper, entitled, "On the Influence of the Tricuspid Valve of the Heart on the Circulation of the Blood." By T. W. King, Esq., M.R.C.S. Communicated by Thomas Bell, Esq., F.R.S., —was resumed and concluded.

The purport of this paper is to prove experimentally that the tricuspid valve of the human heart does not, in the ordinary state of the circulation, completely prevent the reflux of blood from the ventricle into the auricle on the right side, and that the amount of regurgitation is continually varying according to the different degrees of distention of the ventricle. The author points out the anatomical differences between the auriculo-ventricular valves on the right and left sides of the heart; from the consideration of which it might have been inferred, independently of direct experiment, that while the structure of the mitral valve is adapted to close accurately all communication between the left auricle and ventricle during the contraction of the latter, that of the tricuspid valve is designedly calculated to allow, when closed, of the flow of a certain quantity of blood from the right ventricle back again into the auricle. The comparatively imperfect valvular function of these latter membranes is shown by various experiments on recent hearts, in which it was found that fluids injected, through the aorta, into the left ventricle, were perfectly retained in that cavity, by the closing of the mitral valve; but that when the right ventricle was similarly injected through the pulmonary artery, the tricuspid valves generally allowed of the escape of the fluid in streams, more or less copious, in consequence of the incomplete apposition of their margins. On repeating these experiments on different animals the author obtained similar results; but found that the imperfection of the valvular function was greater, the sooner the heart was examined after the death of the animal; and that if the trials were made after the lapse of a certain time, the rigidity which gradually supervened on the muscular fibres of the heart, and of the *carneæ columnæ* attached to the margins of the valves, brought them into more complete apposition and led to the accurate closing of the passage. This effect, however, was never so perfectly accomplished in the tricuspid, as in the mitral valves.

The author regards this peculiarity of structure in the tricuspid valve as an express provision against the mischiefs that might result from an excessive afflux of blood to the lungs, analogous to a safety-valve; and as more especially advantageous in incipient diseased enlargements of the right ventricle. He adverts to the conditions of the heart during the fœtal state of existence, in which the same necessity of guarding against excessive pressure does not occur, and where the structures are found to correspond to the variation of functions. A similar adjustment of the right auriculo-ventricular valve to the peculiar circumstances and habits of animals may also be traced by extending the inquiry to various classes of animals.

"Report of a Committee for collecting Information respecting the occurrence of, and the more remarkable Phænomena connected with, the Earthquakes lately felt in the Neighbourhood of Chichester." By J. P. Gruggen, Esq. Communicated in a letter to P. M. Roget, M.D., Sec. R.S.

This paper contains an authentic report of the shocks of earthquakes which, during the last two years, have been felt at Chichester and the surrounding country; drawn up from accounts given by various correspondents, in answer to printed queries extensively circulated. The first shock occurred on the 18th of September, and the second on the 13th of November, 1833. Another and more severe shock was felt on the 23d of January, 1834, and in the latter end of the same year two slighter shocks were experienced, namely, one on the 27th of August, and the next on the 21st of September; the last, which was less than any of the former, took place on the 12th of January, 1835.

The Society then adjourned over Whitsun week to meet again on the 18th instant.

June 18, 1835.

Sir JOHN RENNIE, Knt., Vice-President, in the Chair.

June 18.—The following papers were read:

"Discussion of Tide-Observations made at Liverpool." By J. W. Lubbock, Esq., V.P. and Treas. R.S.

The author has here presented to the Society, by permission of the *British Association for the Advancement of Science*, a discussion by M. Dessiou of about 14,000 tide-observations made at Liverpool, on the plan similar to that adopted with regard to the London Dock observations. The first book contains the moon's transits, classified with the moon's parallax and declination, together with the date and corresponding time and height of high water; the height of the barometer is also added to the observations of about four years. The second book contains the same quantities, classified further according to the different calendar months, and for each minute of the moon's horizontal parallax. The third book contains a similar classification for the moon's declination. The average results are given in tables at the end.

Some remarks are subjoined on the registers of the observations taken at the London and St. Katherine's Docks; from which it appears that the tide is about five minutes earlier in the former than in the latter of these two places; and that the difference in height is about five feet.

"On the Star-fish of the genus *Comatula*, demonstrative of the *Pentacrinus Europæus* being the young of our indigenous Species." By John V. Thompson, Esq., F.L.S., Deputy Inspector General of Hospitals. Communicated by Sir James Macgrigor, Bart., F.R.S.

The author states that the *Pentacrinus Europæus*, which is fixed by its stem to other bodies, and consequently deprived of the power of locomotion, is produced from the ova of the *Comatula*, and becomes in a subsequent stage of its evolution detached, assuming the form of this genus of *Asterida*, and capable of moving freely in the ocean; at one time crawling amongst submarine plants, at others floating to and fro, or swimming in a manner similar to *Medusæ*.

"On the Ova of Women and Mammiferous Animals, as they exist in the Ovaries before Impregnation." By Thomas Wharton Jones, Esq. Communicated by Robert Lee, M.D., F.R.S.

After reviewing the accounts given by various authors of the structure of the ovaries, corpora lutea, and ova in different tribes of animals, the author proceeds to the anatomical description of the ovaries in the human species, which he finds to correspond with those of the Mammalia generally, and to consist of a *parenchyma* or *stroma*, and an envelope or *indusium*, derived from the peritoneum. The stroma immediately under the peritoneal envelope is condensed into the form of a tunic, to which the peritoneum closely adheres, and which has received the name of the *tunica albuginea*, or *indusium proprium*. The vesicles of De Graaf are imbedded in this tunic, and are situated principally near the surface of the ovary: in the human species they are about one fifth of an inch in diameter. The proper capsule of the Graafian vesicle is composed of two layers; the outer being thin, dense, and vascular; the inner, thicker, softer, and more opaque. The nucleus of the vesicle consists of, 1st, a granular membrane; 2ndly, a coagulable granular fluid inclosed in the membrane; 3rdly, a circular mass or disc of granular matter, termed by Baer the *proligerous disc*, connected with the granular membrane on the prominent side of the vesicle, and presenting in its centre, on the side towards the interior of the vesicle, a small rounded prominence, called the *cumulus*, and on the opposite side a small cup-like cavity, hollowed out of the cumulus; and, 4thly, the ovum, which is contained in the cavity just mentioned. The human ovum is so small as to be only just perceptible to the naked eye, being the 150th part of an inch in diameter. It has a soft transparent envelope of considerable thickness, and contains a substance composed of grains, adhering together by the intervention of a delicate mucous tissue. At the inner surface of the envelope, the author discovered a delicate transparent vesicle, about the 900th part of an inch in diameter, and having on one side a small elevation, which, projecting among the grains composing the walls of the granular sac, fixes the vesicle in its place. The author considers this vesicle as being analogous to that described by Professor Purkinje in the cicatricula of the immature eggs of birds, and which exists also in the ova of other oviparous animals, and is termed by Baer the *germinal vesicle.*

The author has also examined the ova of the cow, sheep, sow, rabbit, rat, and mouse; and has found in all these animals a germinal vesicle, differing in no essential particular from the human structure, and in size bearing a proportion to that of the ovum as one to six.

Although there is, at first sight, a considerable resemblance between the nucleus of the vesicle of De Graaf and the immature yelk of the egg of a bird, the author thinks, contrary to the opinion of Baer, that there is no real analogy between them; because, in the Graafian vesicle of the Mammalia there is no membrane surrounding its nucleus similar to the vitellary membrane of the ovum in birds, nor does this latter membrane appear first under the form of a granular membrane. The vesicle of Purkinje consists merely of a delicate capsule containing a fluid; while in the minute ovum of Mammalia there are found all the essential elements of the egg of birds and other Ovipara, namely, an external membrane, analogous to the vitellary membrane, but performing a different function; a granular membrane, containing a thin fluid, corresponding to the immature yelk of a bird's egg; and a vesicle in every respect analogous to the vesicle which Purkinje found in the hen's egg, while still lodged in the ovary. The author considers the granular membrane, proligerous disc, and granular fluid of the Graafian vesicle, as parts which are superadded, and of which there is no trace within the capsule of the ovary of a bird.

"Some Remarks on the difficulty of distinguishing certain genera of Shells; and on some Anomalies observed in the Habitations of certain species of Mollusca." By John Edward Gray, Esq., F.R.S.

In opposition to the opinion of those geologists who consider that all shells of the same form and character have been inhabited by one genus of animals; that all the species of a genus live in similar situations; and that all the species of fossil shells, appearing from their character to belong to some recent genus, have been formed by animals which in their living state had the same habits as the most commonly observed species of that genus,—the author proposes to show, first, that shells having the appearance of belonging to the same natural genus are sometimes inhabited by very different animals; and, secondly, that some species of shell-bearing molluscous animals live in different situations from the majority of the species of the genus to which they belong, or even have the faculty of living in several different situations. Thus, although the animals inhabiting the shells belonging to the genera *Patella* and *Lottia* are extremely dissimilar in many essential features of their organization, the shells they form cannot be distinguished from one another by any known character. In other instances, when the animals are very different, the distinctive characters of the respective shells belonging to them are so slight as to be insufficient for the purpose of classing them under separate species; and this difficulty of discrimination must be much increased in the cases of fossil shells, especially of those which have no strictly analogous forms among recent shells.

In support of the position advanced in the second part of the paper, namely, that numerous exceptions occur to the identity of habitation among all the species of the same genus of conchiferous Mollusca, the author adduces examples: 1st, where the species of a genus are found in more than one situation, as on land, in fresh and in salt water; 2ndly, where one or more species of a genus, the species of which generally live in fresh water, are found in salt or in saltish water; 3rdly, where one or more species of a genus, which is generally found in the sea, are, on the contrary, found in fresh water; and, 4thly, where the same species of shell is found both in salt and in fresh water.

"On the supposed Existence of Metamorphoses in the Crustacea." By J. O. Westwood, Esq., F.L.S. and Secretary to the Entomological Society. Communicated by J. G. Children, Esq., Sec. R.S.

The author refers the principal modifications of form which occur during the progressive development of animals to the three following heads: 1st, that of an animal produced from the egg in the form which it is destined to retain through life, its only change consisting in a series of moultings of the outer envelope, attended merely by an increase of size, and not by the acquisition of new organs; 2ndly, when the animal, at its exclusion from the egg, exhibits the form which it continues to possess, subject to a series of moultings, during several of the last of which certain new organs are gradually developed; and, 3rdly, when the form of the animal, at its exclusion from the egg, is totally different from that under which it appears at the later periods of its existence; such change of form taking place during two or three of its general moultings, and consisting, not only in the variation of the form of the body, but also in a complete change in the nutritive and digestive systems, and in the acquisition of various new organs. This last phænomenon peculiarly characterizes what is termed a *metamorphosis*.

It is the received opinion among naturalists that the Crustacea do not undergo metamorphoses, properly so called, and that the transformations they exhibit consist merely in the periodical shedding of the outer envelope. The object of the present paper is to establish the correctness of this opinion, in opposition to that of Mr. J. V. Thompson, who has laid claim to the discovery that the greater number of the animals belonging to the class Crustacea actually undergo metamorphoses of a peculiar kind, and of a different character from those of insects. Mr. Thompson's views are founded upon some circumstances which he has observed in certain animals of the genus *Zoea* of Bosc, and which have been recorded by Professor Slabber, and which have led Mr. Thompson to believe that, of these animals, some were the young of the *Cancer Pagurus*, or common crab, and others the young of the *Astacus Pagurus*, or common lobster; and these views are supposed by him to be corroborated by the annual peregrinations of the land crabs to the sea-side, for the purpose of depositing their eggs, rendered necessary by the aquatic habits and conformation of the young. The author proceeds to examine at length the arguments on which Mr. Thompson has founded these opinions, and adduces his reasons for concluding that they are erroneous, and that no exception occurs to the general law of development in the Crustacea, namely, that they undergo no change of form sufficiently marked to warrant the application to them of the term *metamorphosis*.

"Memoranda relating to a Theory of Sound." By Paul Cooper, Esq. Communicated by J. G. Children, Esq., Sec. R.S.

The author, expressing his dissatisfaction with the commonly received theory of the propagation of sonorous undulations by an elastic medium, advances the hypothesis that each particle of an elastic body, after receiving an impulse in a particular direction, and communicating that impulse to the adjoining particle, instead of being thereby brought to a state of rest, is carried back by its elasticity with a velocity which continues its motion beyond the point from which it originally set out, and is thrown into continual vibration, in a manner analogous to the motion of a pendulum. He endeavours, on the principle of a continual transfer of the state of each particle to the adjacent particles, to explain the phænomena of continued sound arising from a prolonged succession of vibrations.

"A Theory of the Tides, including a Theory of the Formation and Propagation of Waves." By the same.

The author applies the principle announced in his paper on the Theory of Sound, namely, that of a continual transfer of state between the adjacent atoms of a medium, to the case of oscillating columns of fluid, constituting waves and tides.

"On the influence of the Respiratory Organs in regulating the Quantity of Blood within the Heart." By James Wardrop, Esq. Communicated by the Hon. Captain De Roos, R.N., F.R.S.

The author observes that the act of inspiration tends not only to favour the passage of the blood into the venæ cavæ, but also to detain it in the pulmonary vessels,—in consequence of the expansion of the lungs allowing of its more ready ingress into the pulmonary arteries, and impeding its exit by the veins—and thus retards its return to the heart. On the other hand, the collapse both of the lungs and of the parietes of the chest, during expiration, assists the transmission of arterial blood from the lungs into the left cavities of the heart, and promotes its passage into the aorta. Thus he considers inspiration as an auxiliary to the venous, and expiration to the arterial, circulation; the first acting like a sucking, and the latter like a forcing pump, in aiding the power of the heart. On this principle he explains the influence exerted on the circulation and on the action of the heart by various modes of respiration, whether voluntary or involuntary, in different circumstances. Laughter, crying, weeping, sobbing and sighing, &c., he considers as efforts made with a view to effect certain alterations in the quantity of blood in the lungs and heart, when the circulation has been disturbed by mental emotions.

"Experimental Researches in Electricity." Tenth Series. By Michael Faraday, Esq., F.R.S. D.C.L., &c. &c.

This paper relates altogether to the practical construction and use of the voltaic battery. Guided by the principles developed in former series, the author concluded that in voltaic instruments in which the copper surrounded the zinc, there was no occasion for insulation of the contiguous coppers, provided they did not come into metallic contact; and therefore in the construction of some new instruments he interposed paper only between the coppers instead of the usual insulating plate of porcelain or glass. The battery thus constructed is essentially the same with Dr. Hare's; and the author recommends even his form of trough for the purpose of putting the acid on to, and moving it from the plates. By attending to certain points described, as many as 40 pairs of plates could be packed into a space not more than 15 inches in length, and thus a very portable, and, at the same time, powerful and convenient trough might be obtained.

In comparing this form of trough with others, the author used acids of constant strength, took note of their quantity, allowed them to act in the troughs until the power of the apparatus had nearly ceased, estimated the quantity of effect by his volta-electrometer, and then estimated the quantity of zinc in the battery employed in producing the effect by the results of an analysis of a given portion of the exhausted charge. In this way it was easy to tell how much zinc was dissolved from any one plate, or from all the plates, and to compare it with the quantity of water decomposed in the volta-electrometer. Thus, with a perfect battery of 40 pairs of plates, an equivalent of water decomposed in the volta-electrometer would be the result of the solution of an equivalent of zinc from each zinc plate, or forty equivalents in the whole; but with a battery not so perfect, a greater proportion of zinc would be dissolved by the acid in the cells.

When the new battery was thus compared with that of the ordinary form, it was found to have greatly the advantage. Thus, with 40 pairs of plates, the former lost 2·21 equivalents at each plate, and the latter 3·54. With 20 pairs of plates, the former lost 3·7 per plate, and the latter 5·5. With 10 pairs of plates, the former lost 6·76 per plate, and the latter 15·5. The author refers to two difficulties still existing in the construction of the battery, but considers its value so great as to deserve receiving that degree of attention, by the application of which these difficulties may be removed.

The author then investigated many other practical points in the use of the battery, ascertaining the influence of various circumstances in the manner already described. Thus he found nitric acid to give a higher result of voltaic action than sulphuric or muriatic acid; the quantity of zinc dissolved in order to produce decomposition of an equivalent of water being only 1·85 per plate when nitric acid was used, 3·8 when muriatic acid was used, and 4·66 when sulphuric acid was employed. The acid which he afterwards used as the best for ordinary purposes consisted of 200 water, 4·5 oil of vitriol, and 4 nitric acid.

The mode of proof adopted by the author was of course independent of the strength of the acid; as was shown by making experiments with the same acid at very different strengths; thus, when nitric acid was used, and the strengths were as 1, 2, and 4, the proportion of zinc dissolved was very nearly the same for the water decomposed. The same result was obtained when sulphuric acid was employed.

The different circumstances of uniformity of charge—purity of zinc—foulness of the zinc plates—new and old plates—vicinity of the copper and zinc—doubling of the copper—first immersion of the plates—number of plates—size of the plates and simultaneous decompositions—were then considered, and such of them as would admit of experimental comparison in the manner already described were put to this test.

The Society then adjourned over the long vacation, to meet again on the 19th of November next.